Amendments to the Drawings:

Attachment: Replacement Sheet(s)
Annotated Sheets Showing Changes

REMARKS/ARGUMENTS

Reconsideration of the present patent application, as amended, is respectfully requested.

In the specification, the applicants found a typographical error on page 9 and have made a correction by an amended paragraph.

With respect to the drawings and the Examiner's objection to Fig. 4A, the applicants assert that the drawing is fully supported in the applicants' specification and direct the Examiner to the arguments below with respect to the rejection of Claims 2-4, 10-12, 18-19, and 28-30 were rejected under 35 U.S.C. §112, first paragraph. In short, the labels, "OC-48" and "OC-192," are fully supported in the specification.

In response to the objections to claims 9 and 13, these claims have been amended accordingly. Furthermore, independent claim 9 has been further amended in accordance with the previous amendment to claims 2-4, 18-19, and 28-30 to obviate the previous rejection maintained against claims 9 and dependent claims 10-14. Applicants assume that the Examiner would now apply the written description rejection immediately below to amended claims 9-14, and make their arguments accordingly.

Claims 2-4, 10-12, 18-19, and 28-30 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Examiner stated:

> Similar to the comments presented in a previous Office Action (Advisory Action mailed on 07 December 2005), Examiner finds that Applicant's amendments to claims 2, 10, 18-19, and 28-30 introduce **new matter**. In particular, notice that they introduce a **particular** coding scheme to a particular 'first' signal in the embodiment of Applicant's invention that employs error correction coding on multiple data signals. Although Applicant's disclosure introduce a particular coding scheme (Reed-Solomon, G. 975, G.709 in p. 9+) on a particular "first" signal (middle signal in Fig. 2), **not multiple** data signals (embodiment in Figs. 4A-4B). Applicant's disclosure does not disclose the use of a **particular** coding scheme (such as Reed-Solomon coding, standard G. 975

coding, or standard G.709 coding) in the embodiment of the invention that employs error correction coding on multiple data signals. Accordingly, as Applicant's amendments to claims 2, 10, 18-19, and 28-30 introduce these limitations that are not taught by the Applicant's disclosure, these same amendments introduce new matter to claims 2-4, 10-12, 18-19, and 28-30. (Examiner's bold fonts)

With due respect, the Examiner is mistaken. The invention is described in the applicants' specification, including pages 8-9 which are quoted here for the Examiner's convenience:

It will be appreciated that many aspects of the design of link 100 (link 100 is found in Fig. 1) may have been determined with reference to the requirements of transmitting optical signals that have been modulated with OC-48 data signals (applicants' parenthesis). In particular, transmission powers and gain levels have been chosen so as to assure that OC-48 receivers are presented with optical signals having sufficient signal to noise ratio while assuring that signal levels are not so high as to exceed the dynamic range limitations of either the receivers or any of the amplifiers employed by link 100. Each wavelength employs the same transmission power and experiences substantially similar gains and attenuations along the link. The OC-192 receivers, however, require a higher optical signal to noise ratio than the OC-48 receivers due to the higher noise power associated with the larger detection bandwidth required for detecting OC-192 signals. For example, typical OC-48 receivers may recover data accurately with an optical signal to noise ratio as low as 18 dB while the OC-192 receiver will require an optical signal to noise ratio of 24 dB.

According to one embodiment of the present invention, a lower OSNR requirement and/or a lower receiver sensitivity requirement is provided to the higher data rate signals by employing error correction coding techniques. In one implementation, the higher data rate signals employ error correction coding on the modulated data while the lower data rate signals do not. The lower data rate signals may then be understood to have a coding gain of zero. Alternatively, error correction coding techniques may also be employed on both the higher data rate and lower data rate signals with different coding

gains. In an alternate embodiment, there are 3 or more tiers of data rate, with different coding gains assigned to the data rates.

In the exemplary implementation that will be discussed in detail herein, error correction coding is employed in conjunction with the OC-192 signals but not with the OC-48 signals. In particular, forward error correction (FEC) techniques are employed. A Reed-Solomon code as specified by the well-known ITU G.975 standard is applied to the OC-192 data at the transmit end. A Reed-Solomon decoder at the receiver end recovers the transmitted data.

Fig. 2 depicts details of 3 of transmitters 102 according to one embodiment of the present invention. Each transmitter 102 incorporates a laser 202 to generate coherent optical energy at an assigned wavelength. The laser output is modulated with a data signal by a modulator 204. Alternatively, the laser may be amplitude modulated by controlling an input. In any case, the modulation input is an analog signal encoded with the digital data to be transmitted. Digital to analog conversion equipment is omitted for simplicity of depiction.

For the OC-48 signals, digital data is formatted prior to being modulated by a framer 206. Framer 206 forms the data into frames.

By contrast, for the OC-192 signals, a forward error correction/framing block 208 is employed. In one embodiment, block 208 applies a Reed-Solomon code specified by the G.975 standard. The Reed-Solomon code is a (255,239) linear cyclic systematic block code. Alternatively, the error correction coding is in accordance with the well-known G.709 standard. Other enhanced forward error correction codes may be used including codes providing greater coding gain than that provided by the G.975 and G.709 standards, e.g., 3 dB or more of coding gain improvement...(applicants' underlining).

The cited portion of the specification teaches in the context of OC-48 and OC-192 data signal (see first specification paragraph cited above), "error correction coding techniques may also be employed on both the higher data rate and lower data rate signals with different coding gains," i.e., the employment of the error correction coding on multiple data signals, in the words of the Examiner. The following exemplary implementation of the applicants' invention discloses specific error correction codes. It should readily evident to one skilled in the relevant art at the

time of the application was filed that the applicants amply described the subject matter claimed 2-4, 10-12, 18-19, and 28-30, and claims 9-14.

Accordingly, claims 5, 13, 23 and 25 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Examiner explained:

> Claims 5, 13, 23, and 25 disclose that a first signal comprises an OC-48 signal and that a second signal comprises an OC-192 signal. Although Applicant's disclosure does teach the use of an OC-48 signal and an OC-192 signal (Figs. 1-2), this usage of particular OC data rates is **only disclosed** for an embodiment of Applicant's invention that employs error correction coding on **only one** data signal (embodiment in Fig. 2), **not multiple** data signals (embodiment in Figs. 4A-4B). Applicant's disclosure does not disclose the use of these **particular** OC data rates in the embodiment of the invention that employs error correction coding on multiple data signals. Accordingly, this limitation of using these **particular** OC data rates in the claimed embodiment of claims 5, 13, 23, and 35 (the embodiment of the invention that employs error correction coding on multiple data signals, i.e., Figs. 4A-4B) constitutes subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

As pointed out above, the first specification paragraph cited above discusses OC-48 and OC-192 data signals and the following paragraph teaches that error correction coding can be applied to these data signals. One skilled in the relevant art, or any reader for that matter, would not read these paragraphs in isolation, as the Examiner suggests, but as a related narrative.

Claims 9-14 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The applicants have amended the claims so as to obviate the grounds for this particular rejection and also addressed the presumed rejection of the amended claims with respect to the arguments over claims 2-4, 10-12, 18-19, and 28-30 above.

Substantively, of pending claims 1-7, 9-14, 16, 18-25 and 27-33, claims 1, 2, 5-7, 9-10, 13-14, 16, 18, 20-25, 27-28, and 31-33 were rejected under 35 U.S.C. §103(a) as being obvious over previously cited U.S. Patent No. 6,433,904, which issued August 13, 2002 to E.A. Swanson *et al.* The Examiner stated

> "Swanson does not expressly disclose: applying error correction coding to said first and second data signals such that said second signal experiences a greater coding gain than said first data signal.
>
> Rather, Swanson discloses applying error correction coding (FEC encoder 40) to **one** of the data signals so that the error correction coded data signal experiences a greater coding gain than the other uncoded data signal. However, coding **multiple** data signals such that one coded data signal experiences a greater coding gain than another coded data signal is obvious within the teachings of Swanson. For example, consider the section "4.Channel Upgrades" on col. 6, l. 6+. It discusses the general procedures for upgrading channels. Swanson provides examples of upgrading from one data rate to another data rate (Fig. 3, col. 8, l. 2-9). However, Swanson does not limit these upgrading teachings to the specific data rates discussed in the examples. That is, Swanson employs a more general formula that applies to a variety of data rates and upgrade situations;
>
> > "If the system was originally designed for a channel at rate R, and it is desired to utilize that channel at rate R', then a code with coding gain of nominally $10*\log_{10}(R'/R)$ should be chosen" (col. 7, l.66-col. 8, l. 2).
>
> Additionally, Swanson describes a variety of codes from which one could choose for implementing a channel upgrade: Reed-Solomon codes, BCH codes, block codes, convolutional codes, concatenated code, SOVA with convolutional codes, etc. (col. 7, l.1-57). These codes provide differing amounts of coding gain. Combined with Swanson's formula quoted above, Swanson's upgrading teachings include a variety of data rate upgrades. For example, a data rate upgrade by a factor of 4 corresponds to $10*\log_{10}(4/1) \sim 6$ dB coding gain, which could correspond to a Reed-Solomon code (col. 7, l. 10-12). A data rate upgrade by a factor of 16 corresponds to $10*\log_{10}(16/1) \sim 12$ dB coding gain, which could correspond to a concatenated code and a block code with SOVA on the

convolutional code (col. 7, l. 34-50). Thus, Swanson's upgrading teachings suggest examples of channel upgrading other than the explicit examples of Swanson (Fig. 3, col. 8, l. 2-9).

Accordingly, it is clear than the limitation of "applying error correction coding to multiple data signals such that said one data signal experiences a greater coding gain than another data signal" is within the bounds of technical capability of Swanson. That is, one could reasonably expect to be able to implement this limitation according to the upgrading teachings of Swanson. However, the question remains, "Would it be obvious to do so?"

At the time the invention was made, yes, it would have been obvious to one of ordinary skill in the art to implement further upgrading of channels (col. 6, l. 8). That is, consider a system that already has an upgraded channel according to Swanson's upgrading teachings, e.g., a system, similar to Fig. 3, with a channel that has been upgraded by a factor of 4, similar to col. 8, l. 2-9. If one desires to further upgrade another channel to increase channel capacity, e.g., by a factor of 16, one would simply apply Swanson's upgrading teachings to a channel that has not been upgraded. That motivation would be the common improvement of increased transmission capacity (col. 6, line 8), which is an explicit purpose of Swanson's teachings (col. 3, l. 3-7).

With due respect to the Examiner, the applicants disagree. First, the sections from the Swanson patent cited by the Examiner as justifying the conclusion that it would be obvious to do so, i.e., "applying error correction coding to multiple data signals such that said one data signal experiences a greater coding gain than another data signal," are conclusions drawn by the Examiner directed by hindsight. The cited section, col. 8, l. 2-9, refers to "considerations in choosing the code appropriate for upgrading the data rate of an existing channel on an existing system without changing the optical amplifiers and other optical hardware." Col. 7, lines 58-61. The example of cited section, col. 6, line 8, shows how a link of 40 wavelength channels of OC-48 can be upgraded with FEC with 6-8 db in each channel and 2640 ps/nm dispersion compensating fiber at the transmitter and receiver, can support 40 wavelength (channels) at OC-

192. Col. 6, lines 11-26. These cited sections do not justify the Examiner's conclusion of obviousness.

Hence the applicants assert that Swanson patent does not render the applicants' independent claims 1, 9, 16, 24, 32 and 33 obvious and the claims should be allowable. Remaining claims 2-7, 10-14, 18-23 and 27-31 should be allowable for at least being dependent upon allowable base claims.

Therefore, in view of the amendments above and the remarks directed thereto, the applicant request that all rejections be withdrawn, that claims 1-7, 9-14, 16, 18-25 and 27-33 be allowed, and the case be passed to issue. If a telephone conference would in any way expedite the prosecution of the application, the Examiner is asked to call the undersigned at (408) 868-4088.

Respectfully submitted,

Gary T. Aka
Reg. No. 29,038

AKA CHAN LLP
900 Lafayette Street, Suite 710
Santa Clara, CA 95050
Tel: 408-701-0035
Fax: 408-608-1599